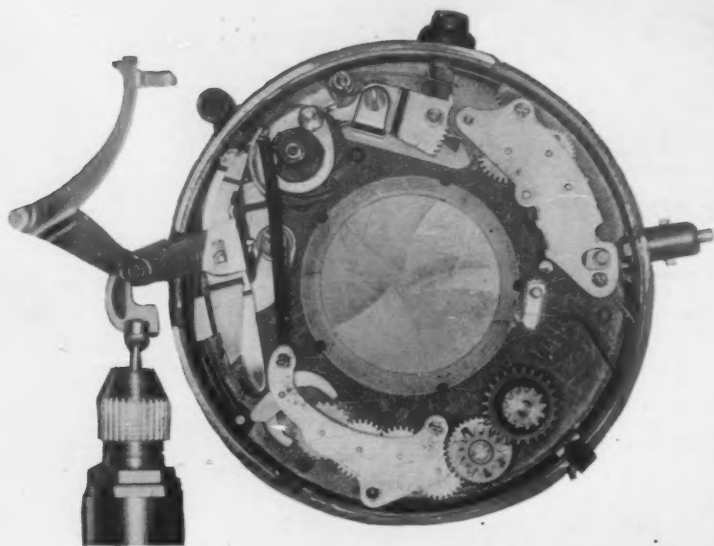


VOLUME 7
NUMBER 3
MAY-JUNE 1961
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the

CAMERA CRAFTSMAN



In this issue:

NEW TEST CAMERA
HOME STUDY SCHOOLS



BOOK SHOP

Here are useful additions to your library of technical material. This department will regularly offer suggestions for new books you may wish to acquire. Any reference books, whether or not here listed, photographic or otherwise, will be located for you and may be purchased through National Camera Servi-Shops Supply, Box 174, Englewood, Colorado.

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CAMERA CRAFTSMAN

Volume 7
Number 3

MAY-JUNE 1961

The Periodical of Photo
Technology for Camera
Repairmen

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NATIONAL CAMERA REPAIR SCHOOL, LITHO IN U.S.A.

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THIS MONTH'S COVER

X SYNCH IN SUPERMATIC SHUTTER

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John Goldsmith	Production Manager
Jan VanderBeek	Columnist

A Point to Ponder

By SAMUEL L. LOVE



There's nothing like a good mystery (or even one not so good!) to curl up with-at the end of a day or between front-and-back-yard mowing on Sunday. Or maybe you like westerns-or like me-an occasional science fiction story.

It seems that we "moderns" have bloomed as readers! The so-called "paper-back" publishers have the presses running 25 hours a day in the effort to satisfy the voracious appetite of the new reading public.

Reading used to be a sign of the Intellectual in Society-and it still is. The difference is that today you have the opportunity to make full use of all kinds of books. Sure, the type of book I just mentioned is far from intellectual. Such books are entertaining, if little more. But they can get you into good habits.

But you are in a special position. You're in a spot to really get to know the value of reading in many directions. Working in a field that is changing almost daily (what one isn't?) you've got to develop good reading habits just to keep in step with technological changes.

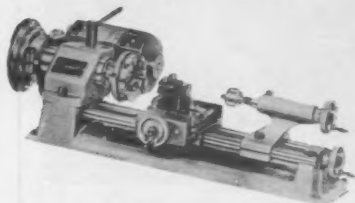
A home-study student gains an education with many a huge advantage that's a by-product of his training method. You quickly learn the meaning of study and reading for self-improvement. You learn that there is a difference between reading for pleasure and reading for knowledge. You can discover that study reading can be pleasant, too. Well-written home-study texts are quite "meaty"-they do not contain a great many extra words. Each sentence is important for full understanding and you cannot breeze through lightly expecting to gather the implications of the "plot" without absorbing each thought as it is presented.

Once you've learned to read this way you'll find a new world opened for the enrichment of your mind and emotions. It will be much easier to delve into the fine writings of both today and the past for your enlightenment. You'll be able to more quickly recognize a book or magazine article for the kind of writing that it is. You can learn to whisk quickly through a magazine, pausing for careful scanning of articles that require

Cont. page 4

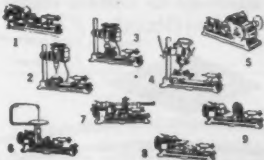
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Basic unit consists of the precision lathe and all components necessary to set up drill press, milling machine, tool and surface grinding machine, hand drill, grinding and polishing machine. Also includes motor, upright steel drill press post, universal 3 jaw (reversible) self centering Cushman type lathe chuck, 3 jaw Jacobs type 1/4" capacity drill chuck, pivoting tool post, 2 dead centers. Face plate, lathe dog, grindstone arbor, Allen wrench, easy to follow instruction manual. Unimat basic unit comes handsomely packaged in sturdy wood storage chest. Complete basic unit, priced \$129.50

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Point to Ponder Cont. from page 3

more thought. You'll be able to appreciate the soul-searching exposition of philosophers or playwrights you may once have thought dull. You'll readily recognize the flavorings that season the words of editorial writers in newspaper and magazine pages. You'll see that printed pages are indeed the open door to the minds of great men and small whether they live today or died a thousand years ago. You might even spot the critical clues in your evening mystery with an ease that amazes!

And above all, put variety into your reading. Make certain that your book shelves grow in many directions. While you may have a hunger for material within your special field, let your curiosity wander a bit. Take a chance on some title that couldn't possibly be interesting. Reach for a book or magazine on a subject completely new to you. Read a little more-you may find you're really living a little - more.

ODDLY ENOUGH

by WALDMAN



THE EXPRESSION
GET OFF YOUR
HIGH HORSE

BEGAN IN THE 14TH CENTURY
WHEN SHOBBISH
ENGLISH NOBLES
BRED AND RODE
TALLER HORSES
THAN ANYONE ELSE.

STAINLESS STEEL

GET IT'S NAME
WHEN PEOPLE FOUND
IT DIDN'T RUST,
FIT OR LOSE
IT'S GOOD LOOKS.
IT IS POPULAR
AS AUTO TRIM
BECAUSE IT
IS SO TOUGH
AND STAYS
SHINY FOREVER.



TURNING THE TABLES

IS A PHRASE THAT HAD
ITS ORIGIN
IN THE WILD WEST,
WHEN A GAMBLER SUSPECTED
A CROOKED DEAL
HE'D DRAW HIS GUN
AND TURN THE TABLE AROUND!



Reports FROM THE CRAFTSMEN

The School might be interested to know that I have gotten a contract with Austin's largest and oldest photo dealer to handle all the repair work on unfranchized equipment, and have been successfully, and profitable, doing this for over a month now.

Kent Anderson
Austin, Texas

I had a chance last week to try out "Millie" (ServiShops Motion Analyzer) testing the operation of flash contacts in a shutter. A man brought in a camera to me that had trouble in the operation of the flash. It would work sometimes, then again it wouldn't.

"Millie" and I ran it down to the connection where the flash cord connects to the shutter. I replaced the connector and now everything is perfect. Result, one satisfied customer.

Russel Phillips
Auburn, Washington

I received my diploma some time ago and am quite proud of it. My high school and college diplomas never rated like this one, for I have them stuck away somewhere, unframed. The NCRS diploma is nicely framed and hanging on the wall in the work shop corner of my room.

L. P. Green
Santa Cruse, New Mexico

In checking my accounts for 1959, I repaired over 350 cameras and as yet I haven't received a complaint on my work. So that's a good sign that my lessons are paying off.

William Justice
Miamisburg, Ohio

First I would like to tell you how much I have enjoyed the National Camera Repair School. I'm doing small repair jobs and hope soon to do more.

William Haines
Wilmington, Ohio

I have better than paid my tuition since I started taking in cameras last February. I figure I have taken in around \$500 in spare time for repair work.

James M. Keck
Nampa, Idaho

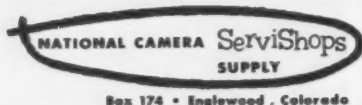
SYNCHRO CONTACTS P.C. 3 mm			Price
	to be inserted into shutter	SCR 1	.75
	metric shutter threaded M4 contact pin 1/2" long	SCR 2	.75
	for Compur, Prontor, Voigtlander and Widelux shutters spring 1/2" long metric screw M 1.6	SCR 3	1.45
	for Quattro shutters etc. spring 1/2" long metric shutter threaded M4 x 0.5 metric screw M 1.6	SCR 4	1.25
	for small and large Compur shutters spring 1/2" long metric shutter threaded M4 x 0.5 metric screw M 1.6	SCR 5	1.25
	for Roliflex-Automatic etc. spring 1/2" long wire 4" long metric screws M 1.6 black leather plate	SCR 6	2.30
	for Roliflex, old Roliflex, Roliflex etc. spring 1/2" long with 2 insulating plates wire 4" long metric screws M 1.6 black leather plate	SCR 7	2.10
REPAIR PLUGS			
	End	Plastic	
	P.C. 3 mm male	black	SCR 13 .30
		ivory	SCR 14 .30
	P.C. 3 mm female	black	SCR 15 .75
		ivory	SCR 16 .75
	double prong (US household plug)	ivory	SCR 17 .45
REPAIR LEADS			
	P.C. 3 mm 12" long, ready for mounting		
	End	Plastic	
	P.C. 3 mm male	black	SCR 18 .35
		ivory	SCR 19 .35
	double prong (US household plug)	ivory	SCR 20 \$1.00

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
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Please furnish me with complete information about your training program.

Name _____ Age _____

Address _____

City _____ State _____

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Congratulations

TO NEW NCRS GRADUATES

Graduation time represents the culmination of studies completed over a period of from one to three years. In many cases this achievement was made under heavy pressures from regular job and family responsibilities. All of these NCRS graduates deserve the highest praise for the diligent attention and unflagging work that went into their course of training.

Carl O. Reinius
Paul Schillerstrom
Gene E. Wheeler
Wilbur A. Gift
C. E. Tavares
William A. Necas
James A. Jackson
Robert A. Peeples
Howard O. Butler
Richard L. Clark
Paul Tenney
Russell S. Phillips

California
California
California
Connecticut
Hong Kong
Illinois
Indiana
Minnesota
New Mexico
Ohio
Ohio
Washington

THOMAS JEFFERSON'S 10 RULES OF CONDUCT

1. Never spend your money before you have it.
2. Never buy what you don't want because it is cheap; it will be dear to you.
3. Pride costs more than hunger, thirst and cold.
4. Never put off until tomorrow what you can do today.
5. Never trouble another for what you can do yourself.
6. Think as you please and let others do so; you will then have no disputes.
7. How much pain have cost us the things which have never happened.
8. Take things always by their smooth handle.
9. When angry count 10 before you speak. If very angry, 100.
10. When at table, remember that we never repent of having eaten or drunk too little.

Push-button "Parking Wheel" for installation underground is Inventor Henry Thomas' contribution to solution of downtown park-aches. Resembling a Ferris wheel, device is fitted with parking platforms. - American Druggist.



study shots

HERE IS WHERE NCRS STUDENTS LEARN

These are pictures of students in the shops they have set up for their training in camera repair.



L. P. Green
Santa Cruz, N. M.



W. Keith Young
Portland, Oregon



Gerald Winters
Carlsbad, N. M.



Tom Nevada
Los Angeles, Calif.



Arthur Howell
Richmond, Calif.



M. L. Shatley
Sherman, Texas



Ralph Schauer
Milwaukee, Wis.



Herbert Murray
Corpus Christi, Texas



Grant Fehrenbach
New Castle, Pa.

NEW CAMERA TESTS RESOLUTION

A research camera recently developed is capable of projecting a parallel line pattern of 50,000 lines per inch. The new camera is a step toward the development of a standard method for measuring the resolving power of photographic materials.

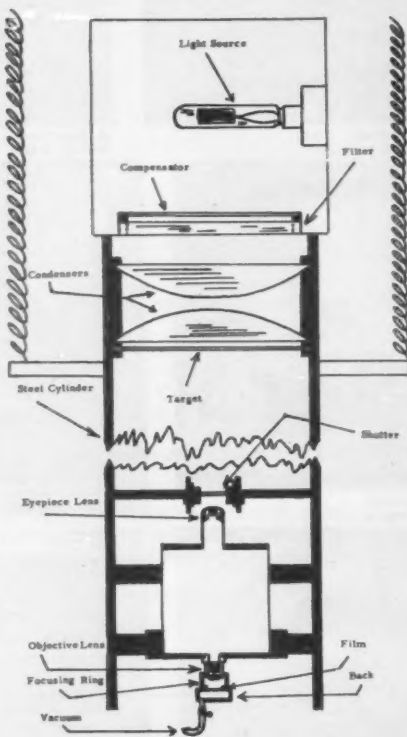
The camera's optical system is basically a fine apochromatic microscope system operated in reverse to make an extremely small image of a large chart. Objectives in use are an 8-mm lens having a numerical aperture of 0.65, which is equivalent to an f-number of 0.77, and a 16-mm lens having a numerical aperture of 0.30 or an f-number of 1.66. Elements of the objectives were respaced and interiors of the lens mounts were blackened to minimize reflections.

Film or plates to be tested are placed against a surface attached to the objective lens mount by a fine screw thread, with a gear mechanism permitting minute adjustment of focus. Film sheets are held in place by a miniature vacuum back. The focus is first set by direct visual observation with a microscope. Several exposures are then made, setting a slightly different focus each time, until the position of best focus is found. The camera is operated at a fixed temperature to avoid changes in focus resulting from thermal expansion or contraction.

To secure even illumination of the targets to be photographed, a compensator plate is placed between the lamp and condensers of the camera's illuminating system. The compensator is a glass sheet with a printed circular pattern that is heavier at the center than at the edges. This compensates for the tendency of the condensers to give higher illumination at the center of the beam. To insure that any limitations revealed by the test are those of the photographic materials and not of the test equipment, the camera must be able to produce a line pattern much finer than can be resolved by the emulsion being tested.

The camera, developed by the National Bureau of Standards, was used in an experiment to test the correlation between resolving power and legibility at an ex-

treme reduction ratio. A photocopy of the first page of the Bible at a linear reduction ratio of 1000 was made, reducing the area by a total factor of one million. If the entire Bible could be reproduced at this reduction ratio, it would cover no more than 1/4 of a square centimeter. The microcopy was made on a high-resolution spectrographic plate using an exposure of 10 seconds at $f/0.77$. It is clearly legible when viewed directly at a magnification of 1250x through a microscope.



SECTION VIEW OF RESEARCH CAMERA CAPABLE OF PROJECTING PARALLEL LINE PATTERNS AS FINE AS 50,000 LINES PER INCH

Measuring

and Testing

LENSES

Continued from
Mar. - April issue.

by G. Barnstedt

The measurement is then taken by first placing a smooth plate on the spherometer ring or points, and reading off the setting of the central measuring pin when it touches the surface. Then the flat plate is replaced by the lens, and the amount by which the measuring pin must be raised or lowered is noted. It is therefore essential to use a perfectly plane plate; it should not deviate from an ideal plane by more than the measuring tolerance of the instrument. With a precise ring spherometer, the meniscus-height can be measured at approximately $\pm 2\mu$. Variations in the surface of the plate should therefore not exceed $\pm 1\mu$.

When measuring test-glasses, however, it is possible to eliminate any irregularities in the plane plate. Test-glasses are always made in pairs, which makes it considerably easier to ensure that the convex and concave surfaces have exactly the same radius. According to whether the convex surface is measured (by means of the inner radius r_i) or the concave surface (by means of the outer radius r_a), one will obtain two somewhat different values r_a and r_i , on account of the unavoidable measuring errors in establishing g and h which are principally due to irregularities in the plane plate. Although these errors are involved in the measurement of both surfaces, their effect is reversed in the second measurement and therefore they can be cancelled out by selecting a mean value:

$$r = \frac{r_i + r_a}{2}$$

The measurement can be simplified still further by not measuring with reference to a plane surface at all, but merely by taking the sum of

the two meniscus height values $k = h_a + h$; and calculating r by means of the single formula:

$$(Formula 12) \quad r = \frac{g^2}{2k} + \frac{1}{2} + c$$

g is the mean value of g_i and g_a ,

$$(Formula 13) \quad g^2 = \frac{g_i^2 + g_a^2}{2}$$

c is a correction term, which in this case must be evaluated.

$$(Formula 14) \quad c = \frac{(h_a - h)^2}{4k} = \frac{(\sqrt{r^2 - g_a^2} - \sqrt{r^2 - g_i^2})^2}{4k}$$

The value of c has an approximate magnitude of 0.01 to 0.02 mm, so that in its evaluation the value $(r - c)$ can straightaway be substituted for r .

The error in r can be obtained from the formula:

$$(Formula 15) \quad dr = \frac{g}{h} dg + \frac{1}{2} \left(\frac{g^2}{h^3} - 1 \right) dh$$

Using a precision spherometer, the values of dh can be taken to $\pm 1\mu$ and dg to approximately $\pm 2.5\mu$; it should be borne in mind that the ring will not be ideally round and the edges will not be ideally sharp, but rather rounded to some degree. Temperature variations of 20°C should likewise be taken into account. With greater variations in temperature, corrections will have to be applied in determining the radius g and the height of meniscus h . The radius g is not absolutely constant, but varies slightly with the radius of curvature r which is being sought. The accuracy of measurement can be increased by previously checking the radius g with the aid of a complete sphere or a pair of normal test-glasses, the radius of curvature r_0 which is known precisely: this will be approximately equal to the radius r which is to be measured.

From the equation for dr it follows that the error will be smaller, the larger h is in relation to g . Therefore the largest possible ring should be employed. It is moreover advantageous to measure test-glasses rather than individual lenses, since the test-glasses will be made almost in the form of hemispheres, so that g/h is almost equal to 1. Using always the most appropriate rings, and taking into account the above-mentioned errors, the radius of curvature of the test-glasses can be determined to approximately ± 0.01 to 0.02 mm. Only when the radius of curvature are significantly larger than the radius of the largest spherometer, will the margin of error become greater.

The meridian arc of an aspherical lens surface can be determined by means of the Moffitt slide spherometer (Fig. 12). Here the position

Cont. page 2

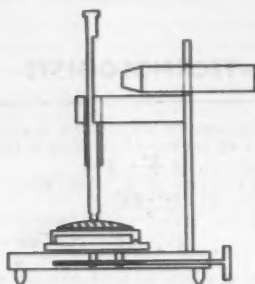


Fig. 12 Moffitt slide spherometer.

of the lens is not fixed rigidly, but is moved beneath a scanning pin, which measures the height of the surface. The height of the meniscus is thus determined as a function of the lateral displacement. Care should be taken to ensure that the scanner actually slides over the crown of the lens; for this the lens must be moved in two directions; moreover the point of the scanner must not be a true geometrical point, but rather a sphere of radius k . The values obtained should therefore be subjected to correction, according to the form of the meridian arc.

Geometric-Optical Methods

The geometric-optical methods employ the spherical surface area (the radius of which should be measured) as a mirror. By employing suitable techniques it is possible to measure the focal length of this mirror, and from this the radius can be determined, since $r = 2f$.

For instance, it is possible to start by determining the focal length from the relation between the object-size, image size and object distance.

Another method involves auto-collimation. The slit S_p of the auto-collimator ocular is reproduced on a reduced scale by an auxiliary lens. If the surface to be measured is used as a mirror, there are two positions of the test sample in which the auto-collimator image $S''p$ originates in the cross-hair plane of the ocular O_k ; in position I the image $S''p$ appears in the centre-point of curvature, in position II at the crown of the surface. It is only necessary to measure the distance between the two positions to find the radius required. This method is especially suitable since the lens surfaces do not have to be touched at all (Fig. 13). The accuracy of this method is greater the larger the lens diameter relative to the radius of curvature. The average margin of error to be assumed is ± 0.03 mm.

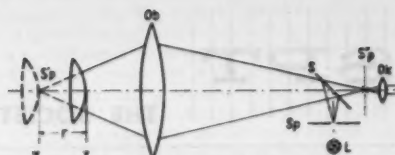


Fig. 13 Auto-collimation procedure for measuring radius of curvature.

With special constructions, the error can be said to be $\pm 1 \mu$.

Interference Optical Methods

When a lens with a large radius of curvature is placed on a plane-surface plate and the set-up is then illuminated from above with monochromatic light, a series of lighter and darker concentric rings (Newton's rings) are seen about the point of contact. Part of the light is reflected at the spherical surface, part at the plane surface; on their return journey, both components interfere with one another. Where the dark rings occur, the path difference is a whole multiple of one wavelength and the thickness of the air-space between the plate and the lens is a whole multiple of a half-wavelength. If, for example, the thickness at the n dark ring is $n \frac{\lambda}{2}$, at m ring $m \frac{\lambda}{2}$, then the difference in thickness is $(m-n) \frac{\lambda}{2}$. From this difference in thickness, and with the help of radii Q_m and Q_n of the appropriate dark rings and the wavelength of the illumination used, it is possible to compute the radius of curvature r of the lens (Fig. 14).

$$r = \frac{Q_m^2 - Q_n^2}{(m-n) \lambda}$$

Formula 16

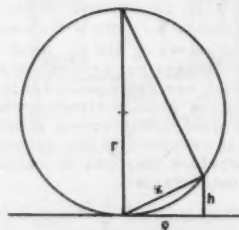


Fig. 14 Interference-optical measurement of radius of curvature by means of Newton's rings.

It is therefore necessary to determine the radii of two selected dark circles - this is best done with a measuring microscope - and to count the light rings which lie between them.

The advantage in this case is that the values of n and m need not be known individually - the rings in the centre are often difficult to count - but only the difference $(n-m)$. This method is not as precise as the others, and is chiefly suitable for very large radii. In place of the plane surface, it is also possible to employ a curved surface with reverse curvature, having a known radius r_0 . If the surface to be measured is not essentially different from the comparison surface, the following equation applies:

$$r = \frac{1}{(m-n) \lambda} - \frac{1}{r_0}$$

Formula 17

This technique is very often used in this way, not to measure the radius, but to check that the variations in radius in a series of similar lenses do not exceed a specific tolerance. Using the test-glass method mentioned, a test-glass with reverse curvature is placed on top of the lens to be tested, whereupon no interference patterns will be visible if both radii are equal. Since the air space increases from one dark ring to another by $\frac{\lambda}{2}$, the distance between the two glasses will be approximately 1μ at the third ring, if λ is taken as 0.6μ . The radii can thus be determined to an accuracy of a few μ , the accuracy being greater the smaller the ratio between the radius of curvature and the diameter of the lens body. This represents a degree of accuracy which will scarcely be found in any other branch of industrial manufacture.

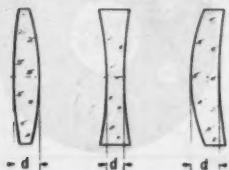


Fig. 15 The thickness of different lenses.

Measurement of Thickness

By the thickness of a lens is meant the distance between the apices of the two lens surfaces. The apices are the points of intersection of the two lens surfaces with the optical axis

(Fig. 15). As we have defined the thickness of the lens, we will therefore no longer refer to the thickness, but only of the height of the apex or meniscus.

Mechanical Processes

The simplest method is to place the object which is to be measured between two feeler gauges and to measure the displacement relative to the setting obtained when both feelers are in contact with each other; another method is to perform a comparative measurement against a sample possessing the standard dimensions. When measuring, it is very important to ensure that the measurement is performed exactly at the axis; it is very easy to misplace the feeler gauges and so obtain false readings. To avoid damaging the lens surfaces, the feeler points must be well polished.

Pneumatic Method

Non-contact methods, such as pneumatic techniques, are particularly useful. Here, air is ejected at slight excess pressure from a duct possessing a circular cross-section. The discharge velocity is proportional to the area of cross-section, $\pi d^2/4$. If one places a surface at distance a from the duct, then the discharge velocity for the effective area of cross-section is only πda in cases where $a < d/4$ (Fig. 16).

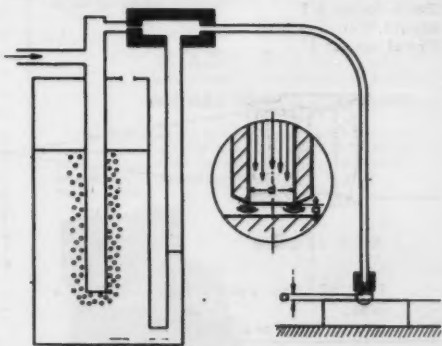


Fig. 16 Principle of pneumatic method of measuring lens-thickness by means of air pressure. It is important that the diameter of the duct d is larger than the distance a (see sectional enlargement).

Cont. page 4

Testing Lenses, Cont. from page 3

The smaller a becomes, the less is emitted and the pressure in front of the duct rises. The differences in pressure is measured with a pressure-indicator, which provides a value for the distance a , and also for the variation in the thickness of the test sample, which is placed on a suitable surface in front of the duct alongside a standard sample. This method is speedy and precise, and makes it possible to measure variations in thickness with an accuracy of 1μ .

Measurement of Optical Constants

The knowledge of the constants of an optical system - back-focus, flange distance and focal length (Fig. 17) - is both important in the mounting of the lens in a camera, and also makes it possible to check the accuracy of manufacture by comparison with the computed values.

In measuring these values, it is generally necessary to know the precise position of the focal plane. This is done by using the lens to be tested to form an image of a real or visual object in the image space, and to determine the position of focal plane by one of the methods to be described. The accuracy with which this can be performed has an important effect on the results, and the greatest care must always be taken with this operation. Equal care must be devoted to the measuring system; for this reason a description of the arrangement is given first, together with the methods of adjusting the position of the image.

Back-focus $S'F'$
Mount distance $S'm$
Focal length f'

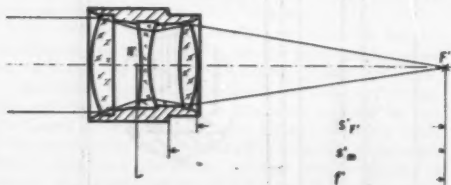


Fig. 17 The optical constants of a lens.

Determining the Focal Plane

The equipment must be set up very carefully on a rigid optical bench. It is important that the test object, the collimator lens, the lens to be tested as well as all viewing equipment should all lie exactly on the same axis. The viewing equipment must be movable for measurement; the movement is measured on a millimeter scale, although for precise measurements a dial

gauge reading down to 0.01 mm or even 1μ should be provided. For many purposes it will be advantageous if the position of the test object can be altered measurably.

Object at Infinity

Greatest care should be taken with the object used for forming the image. The conditions set out below apply chiefly to focusing techniques in which the eye plays a part; special cases may require different objects. Naturally, any available flat object can be used, as long as it possesses sufficiently fine details on which the image can be focused, i.e., lattice masts, etc.

It is better however, to use special test charts, since they provide ideal criteria for judging the sharpness of the image formation. Very effective are test charts containing a light grid pattern on a dark ground, with varying grid spacing in a variety of directions, as well as dots, rings, letters, etc. (Fig. 18).

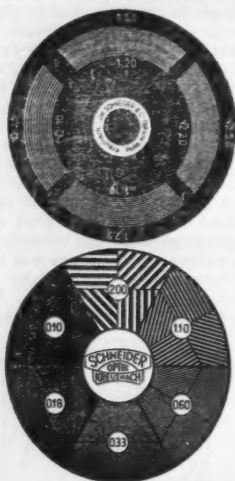


Fig. 18 Two collimator test charts.

(Cont. next issue)

We are indebted to Mr. Norman C. Lipton, Photographic Information Service, New York, N. Y.; and Jos. Schneider & Co., Optische Werke, Kreuznach, Germany for what we believe is a very informative article on "Measuring and Testing Lenses." -Ed.

THE AUTOMATIC CAMERA

With the large number of automatic cameras in use and in production, automation has become an important part of the photographic field. Automatic cameras are of assistance to both the novice and expert photographer. For the expert, the automatic camera increases the speed and ease of getting photographs and, for the beginner, it simplifies photography under complex conditions.

A variable shutter and aperture coupled to a built in exposure meter are the basis of the automatic camera. A further refinement in exposure automation is the programming ring, which allows both the speed of the shutter and the aperture to change in compliance with a predetermined program in response to different light conditions.

One of the most widely used automatic systems with a programming ring is based upon the Alfred Gauthier Prontomat-S Shutter. With this system, when the camera release is depressed a spring pulls down the tracing element, while at the same time a locking device locks the exposure meter needle in its position. The downward motion of the tracing element is stopped as soon as one of its notches engages the locked exposure meter needle. By means of a drive, the motion of the tracing element is transferred to a stop lever. As the camera release is further depressed a program ring is set in motion. This program ring is provided with two curves: one curve to set the aperture, and another curve to set the shutter speed. By engaging the notched curve, the stop lever stops the motion of the program ring, and speed and aperture are set in conformity with the exposure meter reading. The speed curve of the program ring is traced by a speed tracing lever, which transfers the traced values over a speed control lever to the slow speed assembly. The values of the aperture curve are transferred by a diaphragm tracing lever over a diaphragm ring control lever to the diaphragm ring, which by properly positioning the diaphragm blades sets the appropriate aperture.

To function properly, it is necessary that automatic cameras, like all fine cameras, be maintained in topnotch condition.

There are two massive social forces that resist the encroachment of Gov't. These are resentment against high taxes and resentment against loss of individual liberties. The man of independent mind can encourage these forces by intelligent conversation and astute action. -- Dr. Perry E. Gresham

KENNEDY *all steel tool kits*



Positive spring stop prevents accidentally pulling drawer all the way out of cabinet. Spring catch can be released for quick removal of drawer.

The Kennedy line offers outstanding economy and value when fine tools are to be stored. Solidly built--reinforced by inside walls, which ensure rigidity and also support the drawers. The Model 520 has seven drawers sized to fit a wide variety of small tools. Compound drawer slides are equipped with positive stops which prevent spilling. Patented spring catches make it easy to remove drawers. All drawers are completely felt lined and can be drawn out their full length for a clear view. Slides work easily and smoothly without sagging even when heavily loaded. Adjustable partitions in each drawer except the bottom one.

Front panel slides underneath drawers when box is in use -- friction catch holds it there. Fits outside, holding drawers closed for carrying (locks with lid lock). Bright zinc plated fittings make attractive combination with brown ripple baked enamel finish. Dimensions: 20 x 8-1/2 x 13" Weight 27-3/4 lbs.

Till in Top	20 x 8-3/8 x 3-3/4
Four Drawers	8-5/8 x 7-1/2 x 1
One Drawer	8-5/8 x 7-1/2 x 2
One Drawer	18-1/4 x 7-1/2 x 1-1/2
Bottom Drawer	18-1/4 x 7-1/2 x 2-1/2

MODEL 520 \$31.95

The #620 chest has the same rugged construction and time-saving convenience features as the #520 described above. Equipped with three drawers -- top one has four adjustable partitions. Dimensions: 20 x 8-1/2 x 13" Weight 26 lbs.



MODEL 620

\$25.95

Till in Top	20 x 8-3/8 x 3-1/4
Top Drawer	18-1/4 x 7-1/2 x 1-3/8
Middle Drawer	18-1/4 x 7-1/2 x 2-3/8
Bottom Drawer	18-1/4 x 7-1/2 x 3-1/4

A ServiShops PRODUCT

Nat Line:
Flexi-Clamp
WRENCHES



T 751-12P \$3.50 ea.

THESE WRENCHES are very effective tools for removing Lens and Retaining Rings that do not have built in Spanner Slots. You will not mar fine finishes or damage delicate lens mounts when you have a set of these wrenches in your kit. Available for any size diameter job. SIZES IN STOCK to fit:
EASTMAN KODAK LENS CELLS
POLAROID LENS CELLS
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OTHER sizes available on request
PLEASE state size or purpose required when ordering.

Popular sizes: 7/16, 1/2, 21/32, 3/4, 1-1/8, 1-1/4, 1-1/2, 1-3/4

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BOOK REVIEW

Light By Alexander Efron, John F. Rider Publisher, Inc. 127 pages. \$2.25.

Interest in light was evidenced by early Chinese, Greek, and Arabian philosophers who concentrated mainly on the geometry of light rays. Since Sir Isaac Newton's classical experiment in 1666, dispersing white light into its components by means of a prism, man has been interested in the physical properties of light. Until the early part of the 18th century, light was regarded as an emission of high speed particles or corpuscles that were thrown out into space by a luminous body. Due to the geometrical nature of light it was thought that light traveled in straight lines, but this did not satisfactorily explain the refraction of light and at the present time two principal theories are generally accepted: 1. The quantum theory of radiation. 2. The wave theory of light behavior. These theories of light are covered adequately in this book and many experiments are shown to illustrate the physical properties of light.

Full color illustrations are used in the explanation of the spectrum and color theory. This book provides sound basic information about light, and it is an exceptional book in the scientific field as it is quite readable and interesting.

In addition to the formulae given and experiments shown, an entire chapter is devoted to optical instruments and how they operate; explaining camera lenses, microscopes, telescopes, and the human eye. Another chapter is devoted to recent developments in the field of illumination. Suggested illuminance values are given for various situations, such as: auditoriums--10 foot-candles, libraries--30 foot-candles, drafting rooms--50 foot-candles, and die-making--500 foot candles.

The author compares the luminous efficiency of the fluorescent tube with the incandescent lamp. The luminous efficiency of the incandescent lamp varies widely with the voltage applied; however, under ordinary conditions the incandescent lamp is less than 1/2 as efficient as the fluorescent tube. This is an example of the author's ability to progress from the corpuscular theory of light to practical applications. The author also discusses polarized light and X-rays.

Of particular interest to the photographer using color film is his discussion of the additive process of producing color and the subtractive process resulting in color. This book is recommended to anyone interested in light as it competently treats with theories of light and their practical applications. ServiShop Supply, Box 174CC, Englewood, Colorado. -F. Platts

Your ServiShops

QUESTIONS...

By Clair Schmitt



????? NEED HELP ?????

In this column I'll try to answer any camera repair questions you may have. Names will be withheld if requested. Address your questions to: Clair Schmitt, The Camera Craftsman, Box 174 CC, Englewood, Colorado.

Q. Can you give me a disassembly procedure for the older model Exa cameras? Phil Delario

A. Remove the lens and reflex finder. Remove the wind knobs and the rewind shaft will then drop out. Take out the two screws on each side and remove the top covers--loosen the leather pad in the cut-out in the rear of the finder section (just the rear edge). Remove the four screws in the lens mount and take off the mount. Remove 5 screws and the release button cap from the front plate and lift it off. Remove one black screw from the bottom front of the body. Remove one screw from each film chamber (these are at the top of the film chambers and go up into the wind and re-wind sections). Remove the bottom bearing bracket of the sprocket shaft and the top gear (held by a screw) of the sprocket shaft. The whole shutter and mechanism assembly will now slide up and out of the body. It may stick--but you can pry gently in the recesses near the top of the lens opening. Insert a screwdriver blade under the shutter section at the bottom screw hole and a little gentle pull should slide it the rest of the way out (watch the release button). Don't worry about the flash post--the contacts are long spring sections that slide out with the shutter section. The shutter can be operated out of the body for observation and adjustment.

Q. How do I remove the shutter in a Yashica LM for cleaning and repair? Bill Jensen

A. The shutter in the Yashica LM is held in place by the black tube that extends into the body of the camera. This tube is threaded and serves as a retaining ring. Usually there are no slots or spanner wrench holes in the tube and it is best to remove the complete front of the camera before removing this retaining ring tube. The front panel is held by four screws, visible after the leather has been removed.

HELP WANTED

A card to NCRS Placement Service will bring more details about these opportunities. Include code number listed for opening that interests you

01114 Need a good camera repairman to join our company and set-up a repair department or would consider financial support for a camera repairman wishing to start independent shop. Jacksonville, Florida.

0728 Repairman wanted to take full charge of repairs on photographic equipment. Must be able to repair all types of equipment. Tucson, Arizona.

01214 Please furnish us with the name, address, and telephone number of any of your graduates who live in the Pittsburgh, Pa. area and are available for employment. We are willing to consider an advanced student.

0817 Additional camera repairman needed for large centrally located, repair shop. Desire graduate of National Camera Repair School, Detroit, Mich.

1516 Repairman needed with several years experience in instrument and motion picture equipment maintenance and repair. Major airline. Yuma, Arizona

121 Our company would appreciate applications from graduates of National Camera Repair School North Hollywood, California.

01010 Well equipped modern shop needs two camera repairmen. Out-of-town inquiries invited. Top wages. New York, N.Y.

01014 Jacksonville, Florida firm needs experienced, bondable repairman to specialize in tape recorders and 16 mm sound projectors. Will consider someone willing to relocate.

01011 Established camera store in Farmington, Mass. with growing repair department wishes to employ an additional camera repairman able to handle the more complicated types of repair work. Pay commensurate with ability.

138 Motion picture camera repairman needed who has had experience on Mitchells, Bell and Howell, and Arriflex cameras. Our business is primarily in the motion picture field and we would want a man willing to specialize in this field. Hollywood, Cal.

Dealers --- Repairshops --- Service Departments

When you need repairmen, send details to NCRS Placement Service. Your needs will be listed here. Applications of interested repairmen will be sent for your consideration.

Lindstrom * PLIERS



FLAT NOSE PLIERS

Size _____ 4" 4 1/2" 5"

Bright finish Cut jaws \$1.00 \$2.00 \$2.25

Bright finish Sm. jaws 1.00 2.00 2.25



HALF ROUND NOSE PLIERS

Size _____ 4 1/2" 5"

Bright finish Smooth jaws \$2.10 \$2.30



END CUTTING NIPPERS

Length _____ 2 1/2" 4" 4 1/2" 5"

Bright finish _____ \$2.25 \$2.50 \$2.75 \$2.00



ROUND NOSE PLIERS

Size _____ 4 4 1/2" 5"

Bright finish Sm. jaws \$1.00 \$2.00 \$2.25



CHAIN NOSE PLIERS

Size _____ 2 1/2" 4" 4 1/2" 5"

Bright finish Cut jaws \$1.00 \$2.00 \$2.25

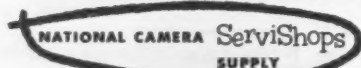
Bright finish Sm. jaws 1.00 1.00 2.00 2.25



SIDE CUTTING NIPPERS

Size _____ 3 1/2" 4" 4 1/2" 5"

Bright finish _____ \$2.25 \$2.50 \$2.75



Box 174 • Englewood, Colorado



Hi There!

from Jan VanderBeek

It sure is nice hearing from so many of you wonderful people and keep those letters coming. Everyone here on the staff wants me to thank you for them for keeping us so nice and busy! We really do enjoy it!

We've had a few more visitors lately, and now that vacation time is coming we hope to meet a whole lot more of you. Our visitors came from California, Utah, New York, Connecticut, and Idaho this time and everyone seems to enjoy visiting or working with the fellows in the shop.

No news on the home front except that we are all talking and planning vacations, and the big thing, our new building, which is in the early planning stages!

Our editor has been worried by the report that the Government has undertaken a crash program to land a man on the moon.

The lake right next door to us sure looks like good fishing. I believe Delphine mentioned this last year. See, the fish were planted here like they are in a lot of places and when the people feed them they really jump out of the water. Course one day it will be a worm with a hook and then no fish!!

The National Home Study Council Convention was held in the neighboring city of Boulder, Colorado the first part of May. Wonderful news! Mr. Love was elected to the Board of Trustees. It sure makes us feel proud of him and of our school to be represented in this way. You see, the National Home Study Council is the Council that accredits home study schools and so it's quite an honor to be elected to the Board of Trustees.

Mrs. Love arranged the ladies program while the convention was here and they had a very interesting program--visiting Central City one day and taking a shopping trip into Denver, plus visiting the National Bureau of Standards in Boulder. Anyway, an interesting time was had by all, especially comparing notes with other "at home" schools! Believe it or not the weather co-operated nicely for the visitors who were from all over the United States! Let me hear from you.

Our Students Speak

I haven't written to you since I joined this school, and I knew that you were expecting to hear from me. I have read with much interest and pleasure and have learned much from my lessons I, II and III.

D. Y. O. Ochieng
Kampala, East Africa

Am really enjoying the course. It's even better than I expected.

Mr. Billy Joe Morris
Pasadena, Texas

My sincere appreciation for all your help in the past and your unflinching patience with students. Have heard many good things of you in my travels and congratulate you on a well earned reputation of sincerity, fairness and service.

Norman H. Hyatt
Yuma, Arizona

Incidentally, I have registered the name of my Camera Repair here in Michigan. While I am being a little pre-mature, I want people to know that I'll be available and am able to handle their repairs--in fact, I have already done a few and get more calls each week. I think I made a wise choice in deciding on camera repair.

Ray Newman
Detroit, Michigan

I have never been associated with any organization which has been so cheerfully ready and willing to go out of their way to assist someone they know nothing about and have never seen. It has certainly been a pleasant experience and a real pleasure to me the past many months. I can well understand why NCRS has been so successful.

Your Supply Department will probably hear from me often.

Rio McFayden
Seattle, Washington

PLASTIC FUSIBLE BELTING

Ends fuse when heated
to form endless belt.

No. 11-174. $\frac{3}{8}$ " diam.—Per Ft. 98.15
No. 11-175. $\frac{1}{2}$ " diam.—Per Ft. .15
No. 11-176. $\frac{3}{4}$ " diam.—Per Ft. .15

RUST REMOVER

4 oz. bottle\$1.70



H-R Rust Remover is non-acid, absolutely harmless to the polished finish of fine parts. You may leave parts in this rust remover overnight. You may dip parts directly into the wide mouth 4 oz. bottle.



HARD ARKANSAS MOUNTED STONES

Length	Width	Each
3 1/4"	1"	\$3.00
4"	1 1/4"	7.00
5"	1 3/4"	9.00
6"	1 7/8"	10.00

HARD PENETRIVE PIECES
(Approx. 1/2 the thickness of regular stones) 1.00

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SERVISHOPS HEADQUARTERS ARE YOUR SPECIALISTS

ServiShops Headquarters advertising is beginning to appear in National magazines. Rely on your Headquarters Shops to back up your own work. For example, electronic specialists and complete facilities here can take care of your repairs on sound equipment, electronic flash and other specialized photographic machinery.

Send repairs direct to ServiShops Headquarters, Box 174 ER, Englewood, Colorado.



Tap-A-Line

IN YOUR WORKSHOP: Tap-A-Line permits you to plug in soldering irons, test lamps, flex shaft, other equipment. Has them all ready and available for immediate use.

IN YOUR STUDIO: Tap-A-Line is convenient for portable lights, flood lights, spot lights.

On Your Test Bench: Tap-A-Line will permit you to plug in all types of flash cords and have them at your finger tips.



Model TL 1 foot

\$2.00

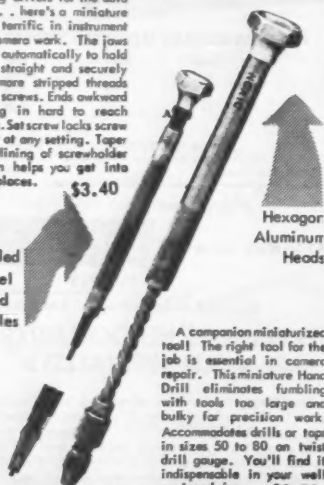


Dixon Miniaturized Tools

You've seen handy screw-holding drivers for the auto trade... here's a miniature that's terrific in instrument and camera work. The jaws adjust automatically to hold screw straight and securely—no more stripped threads or lost screws. Ends awkward groping in hard to reach places. Sets screw locks screw holder at any setting. Taper streamlining of screwholder section helps you get into tight places.

\$3.40

Knurled
Nickel
Plated
Handles



Hexagonal
Aluminum
Heads

A companion miniaturized tool! The right tool for the job is essential in camera repair. This miniature Hanc Drill eliminates fumbling with tools too large and bulky for precision work. Accommodates drills or taps in sizes 50 to 80 on twist drill gauge. You'll find it indispensable in your well equipped shop.

\$3.50

A ServiShops PRODUCT

BIRTHdays!

Mr. and Mrs. N. Lue Shue of Trinidad, W. I. announce the birth of a bouncing baby girl, 8lb. 4oz., April 25, 1961.

A girl was born to Mr. and Mrs. William Warehime of Sterling, Illinois on February 17, 1961. She weighed 8lbs. 10oz. Her name is Donna Mae.

"We received a new addition to our family on March 2, 1961. It is our 4th girl, her name is Tamara, along with our boy we now have five children." N. Thomas Watson, Heber City, Utah.

NEW CAMERA RECORDS VIOLATIONS

A German developed system for photographing cars violating traffic regulations is being tested in Denver, Colorado.

A pair of 35-mm rapid-sequence cameras are mounted on the right side of the patrol car's dashboard and are operated by the driver through remote-control button. The cameras, one with standard lens, and the other with telephoto lens; record the scene ahead at five frames a second. The photographs include the reading of a special speedometer on the right front fender of the patrol car and also the date and hour.

This new system is called "Trafficpax" and is being marketed throughout the United States.

Screen News Digest has devoted an entire film to a single story—a motion picture biography of Dr. Robert Goddard, American's first pioneer in rocket research.

Dr. Goddard's life and work were featured in the January - February issue of the Camera Craftsman.

I believe in America because in it we are free -- free to choose our government, to speak our minds, to observe our different religions.

Because we are generous with our freedom, we share our rights with those who disagree with us.

Because we hate no people and covet no people's lands.

Because we are blessed with a natural and varied abundance.

Because we have great dreams and because we have the opportunity to make those dreams come true.

Wendell Wilkie



BELLOWS

Have we heard from
you lately?

In working with bellows or focal plane shutter material I have found that the layout lines can be made easily and very legible by using a white lead pencil--the type of pencil used when writing in photo albums. No more squinting to see lines made with an ordinary lead pencil.

As I only do my camera servicing in spare hours, I often must start a job one evening and finish it the next evening or even later. Often this means that a shutter must remain in a state of disassembly. To prevent or to at least minimize the amount of dust settling on a partly or completely disassembled camera or shutter etc, I have been storing them in plastic bags or wrapping them in "Saran Wrap" plastic sheeting. Even after the unit is repaired, wrapping it in plastic sheeting keeps it clean until it is delivered to or picked up by the customer.

R. M. McPhail
Stittsville, Canada

If I don't choose to open a shop, the course will be handy in understanding my own equipment.
Charles Schickel
Lancaster, Pennsylvania

I must say, I have enjoyed every moment of the course; altho, I began to wonder if I would ever finish. After once starting to take in repair work, it left little time to study and concentrate on the lessons. As I progressed each camera became a study in itself and the NCRS course became an invaluable aid in coping with the host of various problems involved in repairing photographic equipment.

Yes, I now feel capable and would like to make this letter an application for a National Camera ServiShops Franchise for this area.

I wish to say thanks again for a fine course in camera repair.

Paul V. Briscoe
Ponca City, Oklahoma



You will work better when you see better with this new Binocular Magnifier. May be worn with or without eyeglasses. Leaves both hands free to work. Fine tolerance and precision work can be done easier, faster and more accurately using this equipment. With the Magni-Focuser you see an object in third dimension greatly magnified - with depth and clarity. It reduces eye-strain and prevents squinting - thereby saving time, increasing accuracy and minimizing the chance of errors and accidents. The head-band is adjustable for your comfort. Normal vision may be resumed by slightly raising your head.

Model No	2 magnifies 1-1/2 times at 20"	Price	\$12.50
3	1-3/4	14"	12.50
7	2-3/4	8"	12.50
10	3-1/2	4"	15.00

No 13 and 17 are the same as No 3 and 7 with an auxiliary lens attachment which gives magnification of 4-1/4 and 5-1/4 respectively, with the right eye only. Priced \$17.50 each

draftette®

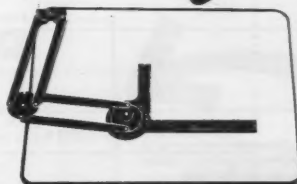
Complete with 10" x 13" drawing board . . . \$5.95

Draftette instrument only . . . \$4.95
(Scale 3" x 5" - 6" arms - 180 degree protractor, Draftette completely assembled - ready for use.)

Draftette with 4" x 6" scale and 11" x 17" Drawing board - Complete . . . \$8.50

Draftette 4" x 6" scale alone . . . \$2.00

draftette®
Complete with 11" x 17" drawing board only **\$6.50**



NATIONAL CAMERA

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SERVISHOP PRODUCT GUARANTEE

When you purchase a ServiShops product, you are sure you're getting the best of equipment. Every product advertised in the Camera Craftsman carries three warranties.

First, you have a ten-day return for refund privilege. If, for any reason, you're not satisfied, you can return your order within 10 days of purchase, for a full refund.

Second, all materials and workmanship of NCRS manufactured products are guaranteed by NCRS for one full year. NCRS will replace any parts or components which might become defective in normal use, if returned to the factory, transportation charges prepaid, within one year of original purchase.

Third, all products and parts handled by NCRS are guaranteed by the individual manufacturers of those products.

National Camera Repair School further guarantees to check and service any ServiShops product no longer within the warranty period, at nominal charge.

NCRS ORDER BLANK

Date _____ 19__

You can order any product advertised in the Camera Craftsman. All products carry the NCRS Return Privilege Guarantee -- Satisfaction or return in 10 days for complete refund!

Shipments are F. O. B. Englewood (Denver), Colo.

Acct. No. _____
 Name _____
 Street _____
 City _____ State _____

How shall we ship? How will you pay?
 Parcel Post Cash
 Railway Express C. O. D.
 Other _____ Other _____

Quantity	Name and Description	Price
	minimum Postage	.30
	Total	

Minimum Order - \$2.00

Signature _____



S. L. Love, Elected to Board of Trustees.

A GOOD TIME WAS HAD BY ALL!!

Boulder, Colorado, was the site for the 35th annual conference of the National Home Study Council. More than 200 delegates from all parts of the United States attended. Samuel L. Love, President of the National Camera Repair School, Englewood, Colorado, was chairman of the planning committee for the convention.

The days were broken into themes and covered various phases of home study education. Some of the subjects covered were: Improving Educational and Student Services, Today's Business Standards and Ethics in Home Study, Home Study in American Education, and Industry and Private Enterprise.

Evening discussion meetings were called, "Cracker-Barrel" sessions and given authenticity with the placement of small barrels with crackers and cheese in each discussion room.

Of particular importance to those interested in the photographic field was the election of S. L. Love, President of National Camera Repair School to the Board of Trustees of the National Home Study Council.

Handy PLASTIC BOXES

These crystal-clear boxes, 8-1/4" x 4-1/4" x 1-1/4" are molded of clear polystyrene, a light hard plastic which retains its polish well. Very handy for storage of nuts, bolts and even fishing tackle.



3 for \$2.00
75¢ each



A.



B.

Please designate type desired.

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NATIONAL CAMERA REPAIR SCHOOL

Box 174
Englewood, Colorado

I am interested in the opportunities and advantages of a career in Camera Craftsmanship. Please furnish me with complete information about your training program.

Name _____ Age _____

Street _____

City _____ State _____



If you have a friend or relative who may be interested in the money making opportunities that exist today in the camera repair field, have him or her fill out this coupon and mail it to the National Camera Repair School Box 174, Englewood, Colorado.

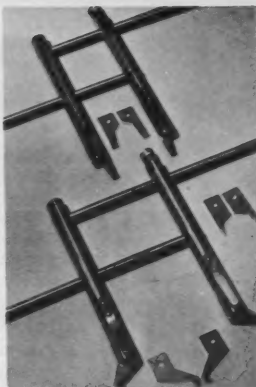
751-1

MULTISPAN WRENCH

\$8.50

Here is the precision spanner wrench designed especially for optical and camera work. It will serve you economically, for the tool accepts replaceable and interchangeable tips. Quickly adjustable from 0" to 4" (even more with proper tips), you lock the setting firmly with a single motion. The MultiSpan's versatility is unmatched because of the many varieties of tips you can use. You can instantly snap a tip for almost any application into one of two positions. Get a complete set of tips which you can use in pairs or in combination with each other.

Blanks with the tip unground are also available. These tips are already heat treated, and plated. You can grind the blade to the required shape for many of the hard-to-get-at retaining rings. Prices shown are per pair.



751-2 Tips, straight, flat, ground.....1.60

751-3 Tips, straight, pencil point.....1.60

751-4 1/8" offset, flat, ground.....1.80

751-5 1/4" offset, flat, ground.....1.80

751-6 3/8" offset, flat, ground.....1.80

751-2u Tips, straight, flat, unground.....1.30

751-3u Tips, straight, point, unground....1.30

751-4u Tips, 1/8" offset, flat unground...1.50

751-5u Tips, 1/4" offset, flat unground...1.50

751-6u Tips, 3/8" offset, flat unground...1.50

751-15 A Special Spanner Wrench for removing narrow shutter retaining rings on the Retina and Karat cameras



\$9.95

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Englewood, Colorado

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